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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/626,550	07/25/2003	Se-Yeul Bae	009844-0305239	9321
909	7590	04/19/2006	EXAMINER	
PILLSBURY WINTHROP SHAW PITTMAN, LLP			MALSAWMA, LALRINFAMKIM HMAR	
P.O. BOX 10500			ART UNIT	PAPER NUMBER
MCLEAN, VA 22102			2823	

DATE MAILED: 04/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/626,550

Applicant(s)

BAE, SE-YEUL

Examiner

Lex Malsawma

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 5-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 5-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 20, 2006 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1 and 5-8 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The amendment to claim 1, which reads, "*wherein the oxide is formed by deposition at the temperature of 150~500 C°*", constitutes new matter because the only description in the specification as originally filed, for forming the oxide reads, "An oxide formed in a furnace with a low temperature, preferably 150~500°C, is used for the insulating layer 35" (see page 4, lines 8-9). The examiner finds no description in the original specification indicating that the

temperature range of 150~500°C is specifically a deposition temperature; therefore, the added limitation, "by deposition", must be removed from the claims. It seems applicant has introduced the new matter in order to distinguish from the oxide-forming process disclosed by Aoki (U.S. Pat. No. 6,387,821), which has been (and is currently) cited in the rejections of all pending claims. Aoki's oxide-forming process, as it applies to the current invention, is discussed in more detail in the remarks section towards the end of this Office action.

Claims 5-8 are rejected because they depend from claim 1. Any further rejections of, or indications of the allowability of, claims 1 and 5-8 are based on claim 1 being interpreted without the added new matter, "by deposition".

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 and 5-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Aoki (6,387,821).

Regarding claims 1 and 5-7:

Aoki discloses (in Figs. 1-4 and Col. 8, lines 18-65) a method of forming metal wiring in a semiconductor device comprising:

forming a bottom metal pattern 105 on a semiconductor substrate (Col. 8, lines 4-5);

forming a low-temperature oxide (HSQ) an insulating layer 106 on the semiconductor substrate including the bottom metal pattern, wherein the low-temperature oxide (HSQ) is formed at the temperature of 150~500 °C (Col. 8, lines 26-28 and note Col. 6, lines 3-4, i.e., Aoki discloses the claimed temperature range of 150~500 °C with “sufficient specificity”) and having a thickness of 1200 nm (12000 angstroms);

forming a first photoresist pattern 107 (Fig. 2a) for forming via hole on the low temperature oxide 106;

forming an unfinished via hole by removing the low temperature oxide selectively for a prescribed thickness using the first photoresist pattern as a mask (Figs. 2a-2b), wherein a thickness of the low temperature oxide remaining inside the via hole equals a predetermined thickness of an upper part of a damascene contact (NOTE: any thickness remaining inside the via hole could be referred to as “a predetermined thickness of an upper part of a damascene contact”, especially when “the upper part”, as currently claimed, is not required to be part of the same damascene pattern as a damascene pattern in which “the unfinished via” will eventually be part of);

removing the first photoresist pattern 107 (Figs. 2a-2b);

forming a second photoresist pattern 108 for forming damascene pattern on the low temperature oxide around the unfinished via hole (Fig. 3a);

forming a damascene pattern by removing the low temperature oxide 106 selectively using the second photoresist pattern as a mask (Fig. 3b);

removing the second photoresist pattern 108 (Figs. 3a-3b); and

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forming a metal-wiring-via-damascene contact 111 by filling metal 111 (copper) in the damascene pattern, wherein the damascene contact is formed by dry deposition (i.e., sputtering) of metal on the insulating layer including the damascene pattern and the planarizing the metal 111 by CMP process (Figs. 4a-4b and Col. 8, lines 58-65).

Therefore, Aoki anticipates these claims.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Aoki** (6,387,821).

Regarding claim 8:

Aoki does not disclose a thickness range of 1,000-20,000 angstroms; however, note that Aoki discloses the low-temperature oxide 106 is formed to have a thickness of 1,200 nm (12,000 angstroms, note Col. 8, lines 27-28). Since Aoki discloses a thickness (12,000 angstroms) falling within the claimed range along with all other limitations of the claimed invention, it would have been obvious to one of ordinary skill in the art to modify Aoki by specifying a thickness range of 1,000-20,000 angstroms because such a range in thickness is considered to be an optimum or workable range for a particular design requirement. Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Remarks

8. Applicant's remarks/arguments have been carefully reviewed and considered, but they are not persuasive for the following reasons.

As noted hereinbefore, the amendment to claim 1 introduces new matter, which is not disclosed in the specification, and it appears that the applicant has introduced the new matter to distinguish the oxide-forming process of the current invention from that disclosed by Aoki (the primary reference applied to claim 1, currently and previously). The applicant continues to assert that Aoki does not disclose or suggest forming the HSQ film at 150-500 °C, especially because applicant asserts that Aoki's HSQ film 106 is a flowable material that is formed as a spun-on-glass (SOG). It is notoriously well known in the art that an oxide formed from HSQ (i.e., an "HSQ film" as described by Aoki) is formed by a process comprising at least the following two steps: (1) coating and (2) subsequent firing (note Aoki, Col. 1, lines 39-41), wherein the "coating step" is commonly performed by "spinning an HSQ precursor onto a substrate" and the "subsequent firing step" is a curing/drying step, which must be performed in order to "cure/dry the HSQ precursor" to acquire an oxide film (which is typically silicon dioxide). In an attempt to put an end to what seems to be a futile argument that does nothing to advance the prosecution of the current application, the examiner cites Cho (U.S. Pat. No. 5,656,555) and Garza et al. (5,456,952) to clearly show it was/is notoriously well known in the art that an oxide film acquired from HSQ is formed by coating an HSQ precursor and curing/drying the HSQ precursor. For example, see Cho's disclosure in Col. 2 (lines 27-49) and Col. 4 (lines 25-42); and Garza et al. clearly show (in Col. 2, lines 31-61) why the second step of "subsequent firing (or curing/drying)" is a critical part of the process for acquiring an oxide film

from HSQ. Aoki clearly realizes that an “HSQ film” must be formed by coating and curing because Aoki discloses in Col. 1, lines 39-41, “*an HSQ film 206 having a thickness of 1,200 nm is formed by coating and subsequent firing*”. This disclosure by Aoki clearly indicates that the “HSQ-film forming process” must include both the coating and firing (i.e., drying or curing) steps, which further indicates that Aoki forms the HSQ film by the conventional, typical, well-known process. Therefore, applicant’s persistent assertion that “*Aoki does not disclose or suggest forming the HSQ film at 150-500 °C*” is simply not persuasive.

With respect to the limitation in claim 1 directed to an equality in thickness, the applicant’s remarks/arguments have been thoroughly reviewed, however, they are not persuasive. Initially, it is noted that claim 1 recites, “*wherein a thickness of the low temperature oxide remaining inside the via hole equals a predetermined thickness of an upper part of a damascene pattern*”; and a careful reading of all limitations in claim 1 indicates that there is no requirement for the “upper part” to be a part of the same damascene contact that is formed by filling metal in the damascene pattern, which was formed by removing the low temperature oxide selectively using the second photoresist pattern as a mask. In other words, the damascene contact formed over/around “the unfinished via hole” need not be the same damascene contact having the “predetermined thickness of an upper part”. Therefore, Aoki anticipates the limitation, “*wherein a thickness of the low temperature oxide remaining inside the via hole equals a predetermined thickness of an upper part of a damascene pattern*”, because “*a predetermined thickness of an upper part of a damascene pattern*” can be any thickness obtained by Aoki for the oxide remaining inside the unfinished via, especially where the “upper part of a

damascene pattern” does not have to be the same “upper part” of a damascene pattern obtained in the subsequent steps recited in claim 1.

With respect to applicant’s remarks/arguments regarding the examiner’s determination of the equality in thickness based “only on the appearance of Figures 3a and 3b”, the examiner agrees with applicant that, within the written disclosure, Aoki is completely silent as to any relationship between the thickness of the portion of HSQ film 106 remaining below the unfinished via hole and the thickness of the upper part of the damascene contact. Aoki’s complete disclosure includes the drawings in combination with the written description, and because Aoki’s written description is completely silent with respect the thickness relationship, one must turn to the drawings for some guidance with respect to such a relationship. In Aoki’s drawings, it is clear that the thicknesses are shown to be equal; and without any written description regarding a thickness relationship, the proper conclusion from Aoki’s complete disclosure would be that Aoki discloses one embodiment wherein the thicknesses are equal. In other words, Aoki’s complete disclosure may not anticipate the thickness relationship being “less than” or “greater than”, however, Aoki’s complete disclosure surely shows/anticipates the thicknesses being “equal”; therefore, Aoki’s complete disclosure anticipates all limitations of claim 1 as currently recited.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 571-272-1903. The examiner can normally be reached on Mon. - Thur. (4-12 hours between 5:30AM and 10 PM).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lex Malsawma

April 13, 2006